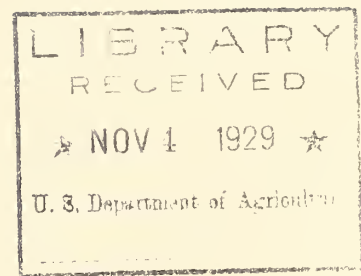


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REVIVING THE SOIL

A radio talk by Dr. H. G. Knight, Chief, Bureau of Chemistry and Soils, delivered through Station WRC and 32 other stations associated with the National Broadcasting Company, Tuesday, October 22, 1929 at 1:30 p.m. Eastern Standard Time.

I have been asked to talk to you for a few minutes today on the subject, "Reviving the Soil." This title suggests at once the idea that the soil is not a dead inert mass and is intended to bring to your minds the suggestion that the soil is the scene of chemical and biological activities which may to some extent be directed and controlled by man. In farm practice many of our operations and fertilizer practices are directed toward the stimulation of these activities with the view of furnishing crop plants with food and conditions necessary for their successful growth and development.

For somewhat over half a century, since it was shown conclusively that potassium, phosphorus, nitrogen, calcium, magnesium, sulphur, carbon, hydrogen, oxygen and iron were essential to plant growth, we have been taught and have been teaching, that only these ten elements were necessary for growth and maturation of our agricultural crops. In fertilizer practice, to increase crop growth, we have contented ourselves chiefly with the application of phosphorus, potassium and nitrogen to our soils, with lime to correct soil acidity and not as plant food, on the assumption that soils, fertilizers and manures supply sufficient of the other mineral elements for profitable crop production. Recent researches, however, have shown that magnesium, iron and sulphur deficiencies, can exist in comparatively large soil areas. Similarly it has been shown that a marked phosphorus deficiency exists in some western soil regions devoted to sugar beet culture so that the application of even small amounts of this element show large increases in sugar beet production.

As a part of its service to the farmer, the Bureau of Chemistry and Soils, conducts field, greenhouse and laboratory studies pertaining to prominent soil types in relation to soil fertility problems. The investigational work concerns itself with a study of the nature and constitution of organic constituents of the soil and their biochemical relationships; the composition of the soil solution in its relation to plant growth; the influences of fertilizers on crop production and on the quality of the products, involving protein, fat, starch and other determinations; the composition of fertilizers; the influence of chemical salts of synthetic origin on plant growth; a study of toxic and beneficial compounds on plant development; and general field investigations with fertilizers on crop growth and production and other soil problems of an important character.

An increased demand for soil fertility and fertilizer studies on prominent soil types has resulted in the establishment of field laboratories by means of which closer contact with soil fertility problems can be maintained. These activities are reflected in the work on cotton root rot in Texas; on pecan soils in Louisiana and elsewhere in the pecan growing belt; on sugar-cane soils in Louisiana; on sugar-beet soil types in a number of sugar-beet growing states, and the cooperative studies of the soils of the Sand Hill region of the South Atlantic.

In connection with these activities field and laboratory work are in progress and definite cooperation with the State Agricultural Experiment Stations and with the various industries involved has been established.

The field work to determine the fertilizer requirements of prominent soil types and the crops grown thereon has been enlarged in scope to include field studies with new nitrogen materials and concentrated fertilizers. As a result of these field investigations more definite recommendations as to the kind and quantity of fertilizer material to use on different soil types is being made possible. Of special importance has been the work with concentrated fertilizers whose use is increasing due to a number of economic advantages they possess, including less hauling and freight as well as fewer bags than ordinary strength fertilizer require. In sections where long freight hauls are involved and the growing season is relatively short the use of concentrated fertilizers is increasing. The field work referred to has been very helpful in guiding farmers and their organizations in the selection and use of these more highly concentrated fertilizer materials. Other problems which these newer materials and their mixtures present, include studies of best methods of distributing in the soil. Such problems are of particular importance on the light soils of the Atlantic and Gulf Coastal Plains' regions where large quantities of commercial fertilizers are used.

In addition to studying highly important nutritional problems on such soil types there has been developed the desirability of determining the influence of certain chemical elements not heretofore associated with the feeding of plants in the ordinary sense. Over a considerable area of the United States, more particularly along the Atlantic and Gulf Coastal Plains, it appears evident that growing crops require more than the addition of fertilizers containing nitrogen, phosphoric acid and potash salts. Under certain soil conditions it has been found that small applications of manganese salts have given striking effects; on other soil types, salts of copper, zinc, boron, iodine, and of similar uncommon soil elements, have given crop response indicative of unusual functions in connection with crop growth and development.

While the fundamental facts connected with the effects on plant growth of these and other uncommon soil elements remain to be worked out, sufficient progress has been made to indicate the importance of such studies. Preliminary experiments indicate that a small application of certain of the so-called minor elements of plant food is an advantage.

The effect of manganese on a highly calcareous soil in Florida where commercial tomato production is being carried on, furnishes a striking example of the practical use of the less common soil elements. It was found there that the difference between success and failure was determined by the use of manganese compounds. As light an application as 50 pounds of manganese sulphate to the acre prevented bleaching of the leaves, stimulated vegetative growth, and insured commercial growers a successful crop of fruit.

On light sandy soils, such as are found in the Atlantic and Gulf Coastal Plains regions, deficiencies of the less common soil elements may prove to be detrimental. This is particularly true in the case of soil types which are subject to more or less constant leaching and have been shown to be deficient not only in the ordinary plant nutrient elements, but in some of the less common ones as well. Furthermore, it has been stated that the continued use of relatively pure salts in fertilizers, especially on sandy soils, may prove detrimental, due

to the absence of impurities which supply some of these less common elements in ordinary fertilizers. The questions involved are of considerable importance and are being given thorough investigation under field conditions to determine not only the fertilizer requirements of light sandy soils but also whether deficiencies of the uncommon soil elements exist, and the practical remedy therefor.

In line with the recent advances in fertilizer practices the commercial fertilizer industry has been going through a gradual but distinct evolution during the past ten or fifteen years, especially with reference to the products it utilizes and the service it renders to the farmer. Among the changes affecting the products have been the constantly increasing use of inorganic fertilizer materials, the elimination of low-grade fertilizers, and the employment of relatively pure fertilizer salts. These are changes of a fundamental character in that the greater use of inorganic materials means that it is becoming a chemical industry, rather than one which formerly utilized to a large extent by-product materials of the packing house and mill.

Remarkable progress has been made in the development of synthetic fertilizer materials during recent years. Probably the greatest progress occurred in connection with the fixation of atmospheric nitrogen during the World War. From this as a starting point the production and utilization of nitrogen salts suitable for fertilizer purposes quickly developed after hostilities ceased.

Because of the high plant food concentration of these new nitrogen materials; because new compounds of phosphoric acid have been developed which contain high percentages of this food constituents; and because potash salts of high potash content are available, there has been rapid development in recent years of concentrated fertilizers. A concentrated fertilizer has been defined as one containing 30 or more per cent of available plant food.

The results so far obtained indicate that in sections where the soil possesses a good water-holding capacity and rainfall is adequate, concentrated fertilizers have shown up well in comparison with those of ordinary strength. On light sandy soils in the Coastal Plain Section where scanty rainfall may be experienced at and following planting, more experimental work will be required as to the placement and distribution of concentrated fertilizers, and as to how thoroughly they should be incorporated with the soil, before it will be practicable to make definite recommendations.

In addition to a study of methods of placement and distribution of concentrated fertilizers, it will be necessary to develop fertilizer distributing machines with suitable attachments to insure proper application and incorporation of the fertilizer with the soil. In some sections of the country, where large quantities of fertilizer are applied to the acre, the use of concentrated fertilizers has passed the experimental stage for farmers are finding out the advantages they possess. On crops which ordinarily receive only a few hundred pounds of fertilizer to the acre it is reasonable to assume that ordinary strength fertilizer will continue to be used to more easily secure uniform distribution in the field.

I am sorry that the time at my disposal will not permit me to discuss the harmful effects of destructive erosion or soil-washing, which is annually destroying many thousands of acres of formerly productive land. The Bureau is studying ways and means of combatting harmful effects of erosion and is establishing field

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stations in the more important soil regions of the country. If you are interested in soil erosion problems send for U. S. Department of Agriculture Circular No. 33, titled, "Soil Erosion a National Menace."

